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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/967,184	09/28/2001	Heikki Heikkila	14766	5971

7590

10/21/2003

SCULLY, SCOTT, MURPHY & PRESSER
400 Garden City Plaza
Garden City, NY 11530

EXAMINER

MCINTOSH III, TRAVISS C

ART UNIT	PAPER NUMBER
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1623

DATE MAILED: 10/21/2003

10

Please find below and/or attached an Office communication concerning this application or proceeding.

FileCopy

Office Action Summary

Application No.

09/967,184

Applicant(s)

HEIKKILA ET AL.

Examiner

Traviss C McIntosh

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 September 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

The Amendment filed August 14, 2003 has been received, entered into the record, and carefully considered. The following information provided in the amendment affects the instant application by:

Claims 1-3, 5, 7, 8, 10, 12-15, 18-24, 27, 29-31, 34-41, 43-45, and 48-49 have been amended.

The replacement abstract has been entered.

Remarks drawn to rejections of Office Action mailed April 8, 2003 include:

Specification/Abstract objection: which has been overcome by applicant's amendments and has been withdrawn.

Claim objections: which have been overcome by applicant's amendments and have been withdrawn.

112 2nd paragraph rejections: have been overcome in part by applicant's amendments and arguments and have been withdrawn in part. See below for complete explanation.

An action on the merits of claims 1-49 is contained herein below. The text of those sections of Title 35, US Code which are not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

Claims 7, 19-26, 31-35, and 37-38 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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The rejection of claim 7 as being indefinite wherein the claim reads “the solution containing rhamnose is a **xylose process stream or side stream**” is maintained for reasons of record. It is unclear what applicant intends by this recitation. Applicant's arguments filed on the bottom of page 11 of the response have been fully considered but they are not persuasive. Applicant's argue that “these terms are of art recognized to the skilled artisan” and “support can be found in the subject specification near the top of page 7”. The top of page 7 of the specification states merely “such solutions are for instance xylose process streams and side streams”, which is not found to be a convincing description. These terms are still found to be indefinite. A side stream, for example, could be a stream which is on the side of a lake. Additionally, claim 7 is indefinite wherein it is unclear as to how the source of the starting solution has any patentable effect on the method as claimed. That is, it is unclear how this recitation would patentably effect the method of claim 1, as claim 7 must necessarily have the same monosaccharides to be separated.

The rejection of claims 19-26 as being indefinite for including the use of “a fraction” or “the fraction” without particularly pointing out the identity of the fraction is maintained for reasons of record. Applicant's arguments filed in the middle of page 12 have been fully considered but they are not persuasive. Applicants argue that “it is clear to the skilled artisan from the description that it is ‘fractions of the starting solution’ which are being fed from one column to the next”. However, in the examination process, it is proper to use the specification to interpret what applicant intends by a word or phrase recited in the claims, but it is **not** proper to read these limitations appearing in the specification into the claim when these limitations are not

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recited in the claim. See *In re Paulsen*, 30 F. 3d 1475, 1480, 31 USPQ2d 1671, 1674 (Fed. Cir. 1994). Defining what is intended by a “fraction” will obviate this rejection.

Claims 31-33 recite the limitation “the pH of a (the) feed solution is...” in the first line. There is insufficient antecedent basis for this limitation in the claim as there has been no indication in any of the claims from which these depend of any feed solution. This rejection is maintained for reasons of record. Applicants state that these claims have been amended to delete the insufficient antecedent basis of the terms, however, the amendment is not seen to overcome the rejection at hand. Incorporating “feed solution” into claim 1 or canceling these claims would obviate the rejection at hand.

All claims which depend from an indefinite claim are also indefinite. *Ex parte Cordova*, 10 *U.S.P.Q. 2d* 1949, 1952 (*P.T.O. Bd. App.* 1989).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1, 12-14, 16, 27-31 and 42 rejected under 35 U.S.C. 102(a) as being anticipated by Heikkila et al. (US Patent 5,998,607).

Claim 1 of the instant application is drawn to a multistep process for recovering rhamnose, arabinose, xylose, or mixtures thereof from a solution containing at least 2 of said

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monosaccharides wherein a weak acid cation exchange resin is used for at least one step of chromatographic separation. Claim 12 provides the weak acid cation exchange resin is an acrylic resin and claim 13 provides various forms of acrylic resins. Claim 14 limits the cation of the resin to be Na^+ , Mg^{2+} , H^+ , or Ca^{2+} . Claim 16 provides the resin is cross-linked with DVB. Claim 27 provides the temperature of the eluate is 10-95°C and claim 28 limits that to 55-85°C. Claim 29 limits the particle size of the resin to 10-2000 μm and claim 30 limits the size to 100-400 μm . Claim 31 limits the pH of the feed solution to 1-10. Claim 42 provides that the method is a batch process.

Heikkila et al. disclose a method of separating xylose from a Mg-sulphite cooking liquor (see example 11, column 9). The xylose is separated from the Mg-sulphite cooking liquor (which is known in the art to contain multiple monosaccharides, including xylose, arabinose, and rhamnose) using a slightly acid cation exchange resin, Purolite C 105™. This resin is known to be a weak acid cation exchange resin (see technical data sheet for product) with a polymer matrix structure of acrylic-divinylbenzene and the resin is shown to be in the H^+ form. Moreover, the particle size of the resin is shown to be 1.2 mm to 0.3 mm (1200 to 300 μm). Heikkila et al. teach the temperature to be 65°C and the pH of the feed solution to be 4.5. Additionally, the process of Heikkila et al. is seen to be a batch process.

The methods of claims 1, 12-14, 16, 27-31 and 42 are seen to be anticipated by Heikkila et al. (US Patent 5,998,607).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-6 and 8-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heikkila et al. (US Patent 5,998,607) in combination with Blaschek et al. ("Complete Separation and Quantification of Neutral Sugars from Plant Cell Walls and Mucilages by High-Performance Liquid Chromatography", Journal of Chromatography, 256 (1983), pp. 157-163).

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Claim 1 of the instant application is drawn to a multistep process for recovering rhamnose, arabinose, xylose, or mixtures thereof from a solution containing at least 2 of said monosaccharides wherein a weak acid cation exchange resin is used for at least one step of chromatographic separation. Claim 2 provides the limitation of eluting the column and separating and recovering a rhamnose rich fraction. Claim 3 provides that a strong acid cation exchange resin is additionally used. Claim 4 provides that an additional step in the process may be crystallization, filtration, evaporation, precipitation, or ion exchange. Claim 5 limits the monosaccharide recovered to rhamnose and claim 6 limits the rhamnose to L-rhamnose and claim 40 limits the form of rhamnose to the monohydrate form. Claim 8 and 10 provide that arabinose rich fraction and xylose rich fraction are further separated and recovered, and claims 9 and 11 limits the arabinose and xylose to L-arabinose and D-xylose. Claim 12 provides the weak acid cation exchange resin is an acrylic resin and claim 13 provides various forms of acrylic resins. Claim 14 and 15 provide limitations to the cation of the resin. Claim 16 provides the resin is cross-linked with DVB and claim 17 provides the crosslinking is 3-8% by weight. Claims 19-24 provide various orders of multiple and various chromatographic separations and claims 34, 35, 37, and 38 provide various orders of recovery of the products. Claims 25 and 26 provide that fractions of eluant are concentrated by evaporation before feeding to the next column. Claim 27 provides the temperature of the eluate is 10-95°C and claim 28 limits that to 55-85°C. Claim 29 limits the particle size of the resin to 10-2000 μ m and claim 30 limits the size to 100-400 μ m. Claims 31-33 limit the pH of the feed solution to be from 1-10. Claims 36, 39, and 41 provide that the products are isolated by crystallization. Claim 42 provides that the method is a batch process. Claims 43 and 44 provide the rhamnose can be collected before or after the other

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monosaccharides. Claim 45 provides that the rhamnose and arabinose are collected together. Claim 46 provides the separation method to be a simulated moving bed system, and claims 47 and 48 provide the moving bed system is either sequential or continuous. Claim 49 provides that there is at least one column or portion of a column which contains a strong acid cation exchange resin and another which contains a weak acid cation exchange resin.

Heikkila et al. disclose methods of separating xylose by using a slightly acidic cation exchange resin (example 11) as set forth supra. What is not taught by Heikkila et al. is to use multiple columns, the order of the various monosaccharides (rhamnose, xylose and arabinose) which are eluted, to use water as the eluant, to use the resin in the Na⁺ form, to concentrate the solution before transferring to the next column, to isolate the products by crystallization, or to use the various simulated moving bed systems.

Blaschek et al. teach of methods of separating L-rhamnose, L-arabinose, D-xylose, D-mannose, D-galactose, and D-glucose by multiple chromatography runs using water as the eluant. Blaschek et al. teach that the various sugars are eluted from columns at different rates, and are eluted from different columns at different rates (see Table 1). Blaschek et al. show that an initial run will separate rhamnose from xylose and arabinose, and then an additional run on a different column will separate xylose and arabinose. Thus Blaschek et al. do indeed recognize that one run on one column is not sufficient to separate various monosaccharides from each other.

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the weak acid cation exchange resin of Heikkila et al. to separate the various sugars, as Heikkila et al. teach the Purolite C 105™ column (which is a weak acid cation exchange

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resin) to be effective in separating xylose from a Mg-sulphite cooking liquor and one would have been motivated to use this column as it is known to be effective in sugar separation and multiple columns are shown to be effective when separating multiple sugars. Moreover, it would require little more than routine skill in the art to design a chromatographic separation process comprising multiple columns and determining the elution times of the various saccharides in a solution and develop a multiple column system which optimizes the elution time/product/column type relationship to obtain a system which is able to separate the various saccharides. One of ordinary skill in the art would understand that different products are eluted from columns at various rates as divergent products are known in the art to be obtained at various pHs in chromatography columns because of their different properties and reactivity kinetics. One of ordinary skill in the art would recognize that the various products would be eluted at various rates in a chromatographic column based on both the properties of the column and compound eluted. It would be obvious to one of ordinary skill in the art at the time the invention was made to add an additional chromatographic column which has different properties than the first column to purify a solution which has multiple compounds that would react differently to different columns and be eluted at different rates among the various columns. One would be motivated to have a multi column system and or a column with various zones which have different properties, such as ionic strength, to separate various compounds which are in the same solution as the products would be eluted at rates dependent upon the column/compound properties. One would be motivated to add the weak-acid cation exchange resin column of Heikkila et al. as Heikkila et al. teach that this column is effective in removing xylose from a solution which inherently has multiple compounds.

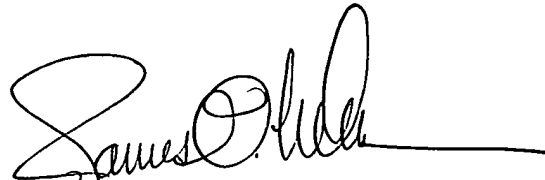
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Traviss C McIntosh whose telephone number is 703-308-9479. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James O. Wilson can be reached on 703-308-4624. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0196.

Traviss C. McIntosh III
October 8, 2003



James O. Wilson
Supervisory Patent Examiner
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